the continual repetition of these changes will likewise produce an equilibrium. According to these principles he undertakes to explain all the laws of increasing and decreasing heat; he supplies us with various examples as to the application of them, and shows how this theory coincides with the general law laid down in the first part of the paper.

The drift of this treatise will be still further illustrated, if we attend to the following recapitulation given us by the author of the leading principles deduced from the various parts of his investigation.

1. The effect of a constant source of heat upon the thermometer is not proportional to the heat of that source.

2. We nevertheless possess a method of determining the heat of the source by its effect on the thermometer, because we know the law this effect follows in its successive increments.

3. This method is the only one that ought to be employed when it is required to compare two sources of heat, according to their effect in a limited time, less than that which is necessary to produce the maximum of the effect.

4. In the case of transmitted heat, we must distinguish that which is immediately transmitted, from that which is added by the transmitting body after it becomes heated.

5. If we neglect making the distinction, the interception of heat attributed to the intercepting body is only an inferior limit or minimum; so that it remains undetermined whether the interception has not been much greater, or even total.

6. By applying these principles to Dr. Herschel's experiments, a more exact appreciation may be obtained; it is, however, governed by some accessory circumstances, which have not yet been determined.

7. In those experiments the apparent difference between the interception of heat and of light by the same substances, does not afford any fair conclusion respecting the difference or the identity of light and heat.

8. The law mentioned in the first part of the paper is not only proved by direct experiments, but also by its agreement with the true theory of the earth.

Lastly. This theory is established upon various facts, entirely different from the above law, and it is the only one which agrees with the general phænomena of nature.

Of the Rectification of the Conic Sections. By the Rev. John Hellins, *B.D. F.R.S. and Vicar of Potter's-Pury, in Northamptonshire.* Read July 8, 1802. [*Phil. Trans.* 1802, *p.* 448.]

This, it is to be observed, is only the first part of a more extensive work, and relates merely to the rectification of the hyperbola. After a few strictures on the necessity of not relaxing in our endeavours to improve the method of fluxions, to which the author asserts few additions have been made since its first discovery by the immortal

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Newton, he informs us of the circumstances which led him to the present investigation, namely, the occasion he had some years ago to solve a problem which required the rectification of an equilateral hyperbola.

He then enters upon his subject; and in a first section he investigates in nine theorems the several series which apply to this curve, whose different characters, namely, the ratios of their terms, or rather the rates of their convergency and divergency, depend on the relative proportions of their elements. Of these series one only, and that not the best, is all that he has hitherto been able to find in other works. Two are of the form which is called ascending, and six descending. One of them is of a peculiar form, which can only be understood by turning to the paper. Among these series, he observes, may always be found some which will converge, whether the portion of the hyperbolic arch taken from the vertex be long or short, or of a moderate length; but the ascending series always differs from the descending one by a constant quantity.

In a second section the author treats of the methods of computing the values of the constant quantities, by which the ascending series differ from the descending ones. Here he has recourse to two methods, of which he has already given an illustration in his Mathematical Essays: the one by computing the value of both an ascending and descending series, taking for the ordinate to the axis some small definite quantity; and the other by comparing the values of those series together, when the ordinate is taken immensely great. The former method he says is more general; but the latter, when it can be applied, usually affords the easiest computation.

In the third section are given five examples, which show the use of these theorems, as well as the manner of choosing such as are best adapted to any particular case. In one of these the author corrects an error in the length of a large arch of an equilateral hyperbola, which was first published in the year 1771, and has been since reprinted by some eminent mathematicians.

Lastly, he concludes with some remarks on former writers, and takes notice of the defects of two series given by the late Dr. Waring for the rectification of an hyperbola.

Catalogue of 500 *new Nebulæ, nebulous Stars, planetary Nebulæ, and Clusters of Stars; with Remarks on the Construction of the Heavens. By* William Herschel, *LL.D. F.R.S.* Read July 1, 1802. [*Phil. Trans.* 1802, *p.* 477.]

To this catalogue is prefixed a classification of the multitude of sidereal bodies hitherto discovered, not according to their apparent magnitudes or appearances on our earth, but according to their peculiar nature and arrangement in the heavens. They are divided into the twelve following classes:

1. *Insulated stars,* or such as may be considered out of the reach of mutual attraction; such as our Sun, Arcturus, Capella, Lyra, Si-